PancAlert

An AI Early-Warning System to Flag Post-ERCP Pancreatitis Risk Before the Scope Goes In

ELECOMP Capstone Design Project 2026-2027

Sponsoring Company:

Boston Scientific
300 Boston Scientific Way
Marlborough, MA 01752
Advancing Science for Life - US - Boston Scientific

Company Overview:

Boston Scientific Corporation (BSC), headquartered in Marlborough, Massachusetts, is a biomedical/biotechnology engineering firm and multinational manufacturer of medical devices used in various interventional medical specialties. These specialties include:

- Interventional radiology
- Interventional cardiology
- Peripheral interventions
- Neuromodulation
- Neurovascular intervention
- Electrophysiology
- Cardiac surgery
- Vascular surgery
- Endoscopy
- Oncology
- Urology

Boston Scientific is dedicated to transforming lives through innovative medical solutions that improve the health of patients around the world. Our core values of Caring, Meaningful Innovation, High Performance, Global Collaboration, and Diversity guide our work, define our culture, and empower our employees.

With 48,000 employees worldwide, Boston Scientific invests significantly in research and development, with $1.4 billion allocated to R&D. We offer 15,000+ products that change lives and treat over 37 million patients each year across 140 countries.

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Project Motivation:

Endoscopic retrograde cholangiopancreatography (ERCP) is used to treat gallstones, blocked bile ducts, and pancreatic disease, but it carries a well-known risk of post-ERCP pancreatitis (PEP). PEP is the most common serious complication of ERCP, affecting roughly 8% of cases and approximately 15-25% of high-risk cases; it is fatal in about 0.2% of cases and costs the U.S. health system hundreds of millions of dollars each year.

Clinicians know the categories of PEP risk factors, but those factors are multifactorial and difficult to weigh at the bedside. Preventive measures - rectal NSAIDs, high-volume IV hydration, prophylactic pancreatic-duct stenting for high-risk cases, or a change in technique - may be applied inconsistently because there is no simple, objective, patient-specific risk indicator at the point of decision.

PancAlert is intended to fill this translation gap. The prototype will use structured patient data available before the procedure - demographics, laboratory values, indication, and history - to produce a calibrated PEP probability, a low/medium/high risk tier, and an explainable alert showing the factors that most influenced the prediction. A rules layer will map each tier to guideline-aligned preventive recommendations. The capstone scope is deliberately limited to a prototype: no FDA submission, live EHR integration, clinical trial, new-patient data collection, or deployment on real patients is included. An optional stretch goal would add intra-procedure variables for a real-time risk update.

Anticipated Best Outcome:

The Anticipated Best Outcome (ABO) of PancAlert is:

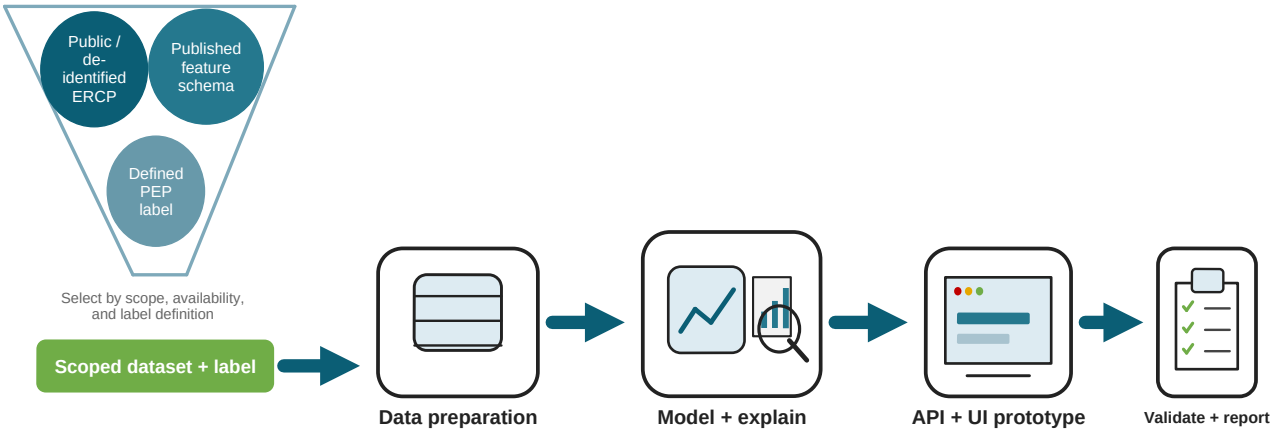
1. A trained and validated pre-procedure model that returns a calibrated PEP risk score and a low/medium/high tier from structured patient inputs.
2. A patient-level explanation of the main risk drivers, together with a rules layer that maps risk tiers to guideline-aligned preventive recommendations.
3. A working prototype application - REST API plus simple web interface - supported by automated tests, containerization, documentation, and a reproducible model pipeline.

Project Details:

Overall system concept:
URI Capstone team and Boston Scientific Inc. team to work jointly to establish overall system concept, including:

- Fix the version-1 scope, inclusion/exclusion criteria, PEP yes/no outcome definition (Atlanta criteria), and evaluation plan.
- Secure a public or de-identified ERCP dataset, or begin from a published feature schema.
- Prepare structured inputs and address missing values, class imbalance, and leakage prevention.
- Implement logistic regression and an existing clinical score as baselines, then train gradient-boosted tree models such as XGBoost, LightGBM, or CatBoost.
- Evaluate AUC-ROC, PR-AUC, sensitivity, and calibration using cross-validation and a held-out test set.
- Generate per-patient SHAP explanations, low/medium/high risk tiers, and guideline-aligned prevention mappings.
- Serve the model through a REST API and lightweight web interface, with clean architecture, version control, automated tests, containerization, and a model-retraining path.
- Validate and document the prototype, its limitations and ethics; pursue intra-procedure risk updates only as a stretch goal.

Block Diagram:



Initial system flow; URI Capstone team and Boston Scientific Inc. team to work jointly to refine the dataset, published feature set, prototype workflow, and validation plan.

Hardware/Electrical Tasks:

- No custom hardware or electrical development is in scope for version 1; the project uses existing software and data environments for model training and prototyping.
- Live EHR integration, deployment on real patients, clinical-trial infrastructure, and regulatory submission are out of scope.

Firmware/Software/Computer Tasks:

- Define the data source, inclusion/exclusion criteria, structured inputs, and PEP yes/no label (Atlanta criteria); preprocess missingness, imbalance, and leakage.
- Develop logistic-regression and existing-score baselines, then compare gradient-boosted tree models.
- Evaluate AUC-ROC, PR-AUC, sensitivity, and calibration with cross-validation and a held-out test set.
- Implement SHAP explanations, calibrated risk tiers, and risk-to-prophylaxis decision logic.
- Build the REST API, web front-end, alert workflow, automated tests, containerization, and retraining path.
- Validate and document the prototype; treat intra-procedure risk updates as an optional stretch goal.

Composition of Team:

2 Computer Engineers

- URI Capstone: Students covering data/ML, backend, front-end/UX, and validation; roles may be combined in a smaller team.
- Boston Scientific Inc.: Endoscopy R&D - AI/ML-Enabled Software (SaMD), with the Technical Directors listed on page 2.

Skills Required:

Electrical Engineering Skills Required:

- NA - version 1 is a software/data prototype and includes no custom hardware.

Computer Engineering Skills Required:

- Data and ML: gradient boosting, imbalanced-data methods, missing-value handling, leakage prevention, model calibration, and SHAP explainability.
- Model evaluation: AUC-ROC, PR-AUC, sensitivity, cross-validation, and held-out testing.
- Software engineering: REST APIs, front-end and UX, clean architecture, version control, automated testing/CI, containerization, and model retraining.
- Data engineering: structured clinical variables and reproducible preprocessing/model pipelines.
- Domain and professional: healthcare AI ethics, clinical workflow design, regulatory awareness, and technical writing.

AI Usage:

The AI Use Policy for this project is defined in Appendix A at the end of this proposal. Technical Directors: complete the checklist in Appendix A to indicate which AI uses are permitted on this project. Any item left unchecked is not allowed.

Anticipated Best Outcome's Impact on Company's Business, and Economic Impact

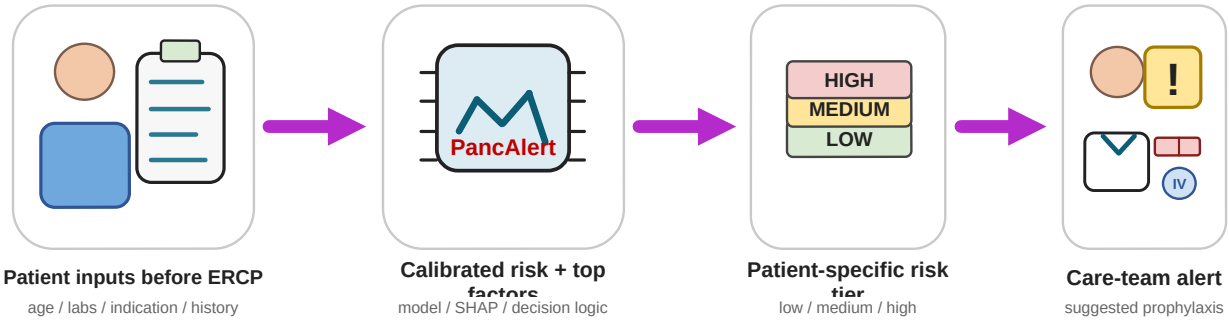
Business impact: PancAlert would provide Boston Scientific's Endoscopy R&D - AI/ML-Enabled Software (SaMD) group with a working proof of concept for explainable clinical decision support. It would combine a reusable API/UI architecture with patient-level explanations, risk-to-prophylaxis mapping, automated tests, containerization, documentation, and a retraining path. The result could support a future decision about clinical validation or product development; regulatory clearance, EHR integration, and clinical deployment remain out of scope.

Economic impact: PEP costs the U.S. health system hundreds of millions of dollars each year. A future clinically validated tool that identifies high-risk patients early and supports timely preventive measures could reduce avoidable pancreatitis and shorten hospital stays. The available project information does not support a quantified estimate of company revenue, cost savings, or return on investment; those estimates would require prospective clinical and business validation.

Broader Implications of the Best Outcome on the Company's Industry:

Personalized, explainable PEP risk assessment could move the field beyond informal bedside weighting of multiple risk factors and beyond research models that stop after retrospective training. PancAlert's broader contribution is a demonstrable path from structured pre-procedure data to a calibrated probability, transparent risk drivers, risk tiers, and an actionable care-team alert. If future clinical validation confirms performance and usefulness, this approach could improve consistency in prevention, patient safety, and the translation of AI research into endoscopy workflows.

Important project limits are explicit: the prototype is not a regulatory submission, is not integrated with an EHR, and is not intended for live patient use. Its industry value is therefore the workflow-ready proof of concept, reproducible engineering foundation, and future-validation plan rather than a claim of clinical effectiveness.



Appendix A: AI Use Policy - PancAlert

Allowed

- Students may use AI tools for
  - ☐ brainstorming support
  - ☐ concept development
  - ☐ literature and publicly available documentation review
  - ☐ software development
  - ☐ debugging
  - ☐ data analysis
  - ☐ test development
  - ☐ non-proprietary paragraph editing
  - ☐ non-proprietary single-slide formatting
  - ☐ preparation of project deliverables
  - ☐ note taking or transcription of meetings
  - ☐ Others: _____

Not Allowed

- Using AI in violation of university policies, applicable laws, or course-specific rules identified by capstone instruction team and project-specific rules identified by the technical directors.
- Entering proprietary, confidential, personally identifiable, security-sensitive, or otherwise restricted information into an AI system without authorization.
- Submitting AI-assisted work without understanding, reviewing, verifying, and appropriately disclosing its use.
- Submitting entire documents or presentations to an AI system for editing or formatting.
- Any unchecked items from the allowed list above.

Requirements

- If any use is allowed, AI tools may only be used to enhance, but not replace, students' technical reasoning, engineering judgment, and understanding. Students must be able to explain, justify, and defend all submitted designs, code, analyses, test results, documentation, and conclusions.
- During the first two weeks of the project, the student team shall work with the Technical Directors to: identify any proprietary or confidential information that may be involved in the project; determine what information may or may not be shared with AI systems; identify the AI tools, models, accounts, and configurations approved

for project use; and document any project-specific restrictions or approval requirements.

- Students shall transparently document the uses of AI using the URI CYPHER AI Usage Marking guidelines (https://web.uri.edu/cypher/ai-marking/). A workshop is planned for September to familiarize students with these guidelines.
- Students retain full professional responsibility for all design decisions, analyses, implementations, testing, documentation, presentations, and final deliverables, regardless of whether AI tools contributed to the work.